# AN5192K

## Single chip IC with I²C bus Interface for PAL/NTSC color TV system

### ■ Overview

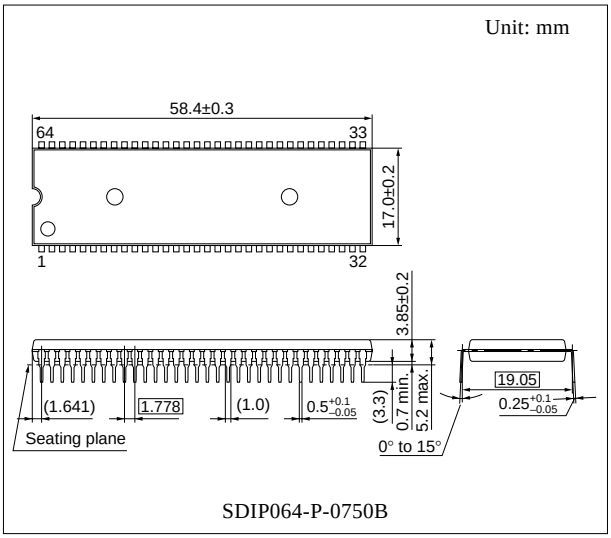
The AN5192K is a single chip IC for PAL/NTSC system color TV. TV for multiple systems can be easily designed by the use of this IC in combination with SECAM demodulation IC (The AN 5637).

### ■ Features

- Free of mechanical adjustment
  Built-in I²C bus interface eliminates the need for mechanical adjustment
- Rationalization of external components
  Built-in chroma trap and BPF reduce the external components

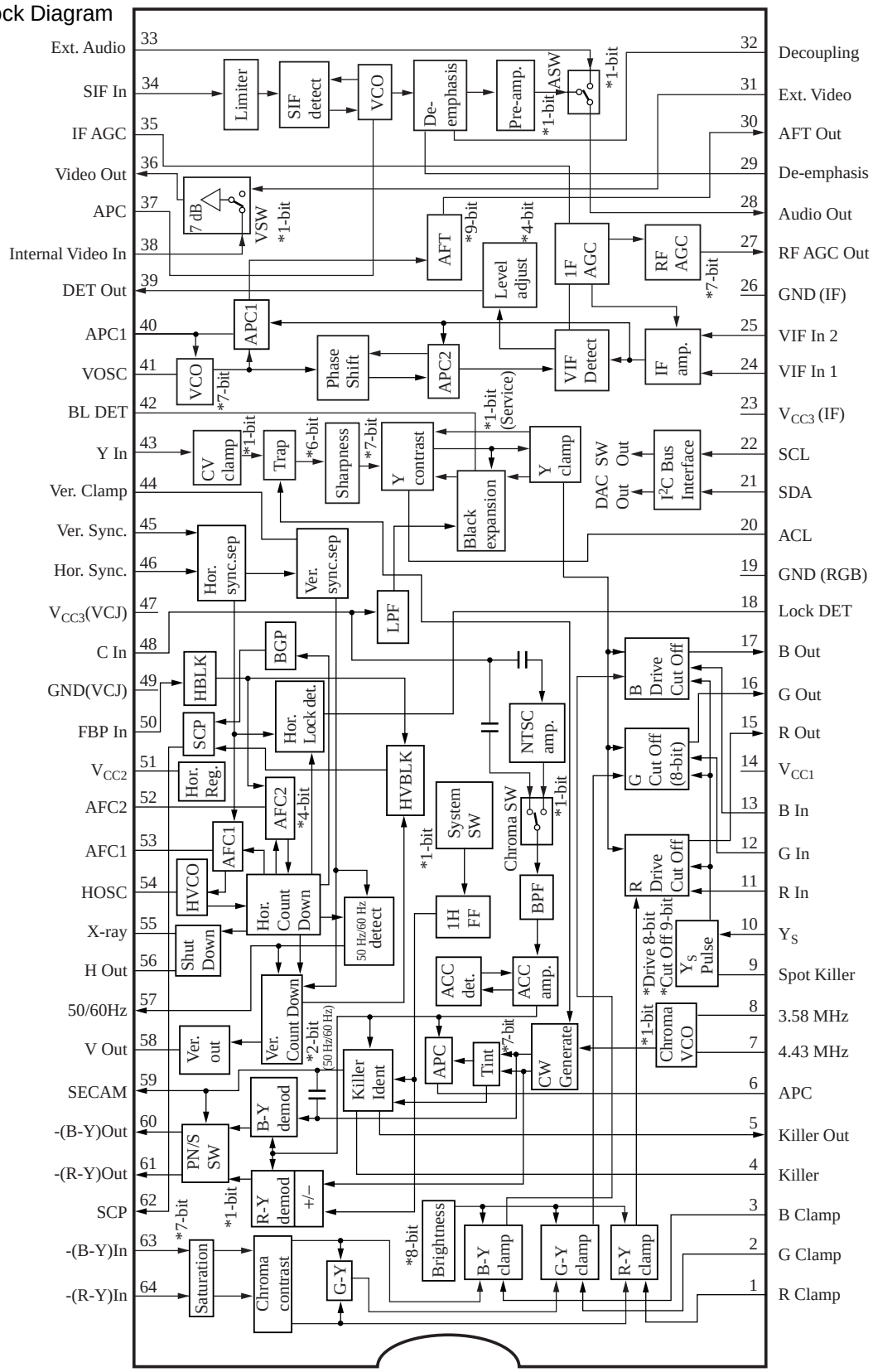
### ■ Applications

- TV, TV with VCR




SDIP064-P-0750B

■ Block Diagram



■ Pin Description

| Pin No. | Description | Pin No. | Description |
|---|---|---|---|
| 1 | (R-Y) Clamp | 33 | External Audio Input |
| 2 | (G-Y) Clamp | 34 | SIF Input/DAC Output |
| 3 | (B-Y) Clamp | 35 | IF AGC Filter |
| 4 | Killer Filter | 36 | Video Output |
| 5 | Killer Output | 37 | SIF APC Filter |
| 6 | Chroma APC Filter | 38 | Internal Video Input |
| 7 | Chroma VCO (4.43 MHz) | 39 | VIF Detect Output |
| 8 | Chroma VCO (3.58 MHz) | 40 | VIF APC1 Filter |
| 9 | Spot Killer | 41 | VIF VCO ($f_P$/2) |
| 10 | Ys Input (Fast blanking) | 42 | Black Level Det./Blank off SW |
| 11 | External R Input | 43 | Y Input |
| 12 | External G Input | 44 | Ver.Sync.Clamp |
| 13 | External B Input | 45 | Ver.Sync.Input |
| 14 | $V_{CC1}$ | 46 | Hor.Sync.Input |
| 15 | R Output | 47 | $V_{CC3-2}$ (Chroma/Jungle/DAC) |
| 16 | G Output | 48 | Chroma Input/Black Expansion Start |
| 17 | B Output | 49 | GND (Video/Chroma/Jungle) |
| 18 | Hor.Lock Detect | 50 | FBP Input |
| 19 | GND (RGB/$I^2C$/DAC) | 51 | $V_{CC2}$ (Hor.Stability Supply) |
| 20 | ACL | 52 | AFC2 Filter |
| 21 | SDA | 53 | AFC1 Filter |
| 22 | SCL | 54 | Hor.VCO (32 $f_H$) |
| 23 | $V_{CC3-1}$ (VIF/SIF) | 55 | X-ray Protection Input |
| 24 | VIF Input 1 | 56 | Hor.Pulse Output |
| 25 | VIF Input 2 | 57 | 50 Hz/60 Hz Detect Output |
| 26 | GND (VIF/SIF) | 58 | Ver. Pulse Output |
| 27 | RF AGC Output | 59 | SECAM Interface |
| 28 | Audio Output | 60 | -(B-Y) Output |
| 29 | De-emphasis | 61 | -(R-Y) Output |
| 30 | AFT Output | 62 | Sandcastle Pulse Output |
| 31 | External Video Input | 63 | -(B-Y) Input |
| 32 | DC Decoupleling Filter | 64 | -(R-Y) Input |

## ■ Absolute Maximum Ratings

| Parameter | Symbol | Rating | | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | $V_{CC1}$ (14) | 10.5 | V |
| | | $V_{CC3}$ (23, 47) | 6.0 | |
| Supply current | $I_{CC}$ | $I_{14}$ | 77 | mA |
| | | $I_{23+47}$ | 119 | |
| | | $I_{51}$ | 27 | |
| Power dissipation *2 | $P_D$ | 1 372 | | mW |
| Operating ambient temperature *1 | $T_{opr}$ | –20 to +70 | | °C |
| Storage temperature *1 | $T_{stg}$ | –55 to +150 | | °C |

Note) ∗1: Except for the operating ambient temperature and storage temperature, all ratings are for $T_a$ = 25°C.
∗2: The power dissipation shown is the value for $T_a$ = 70°C.

## ■ Recommended Operating Range

| Parameter | Symbol | Range | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC1}$ | 8.1 to 9.9 | V |
| Supply voltage | $V_{CC3}$ | 4.5 to 5.5 | V |
| Supply current | $I_{51}$ | 10 to 25 | mA |

## ■ Electrical Characteristics at $T_a$ = 25°C

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Power supply (DAC Data are typical) | | | | | | |
| Supply current 1 | $I_{14}$ | Current at $V_{14}$ = 9 V | 44 | 55 | 66 | mA |
| Supply current 2 | $I_{23}$ | Current at $V_{23}$ = 5 V | 8 | 11 | 14 | mA |
| Supply current 3 | $I_{47}$ | Current at $V_{47}$ = 5 V | 56 | 71 | 85 | mA |
| Stabilized power supply voltage | $V_{51}$ | Voltage at $I_{51}$ = 15 mA | 5.8 | 6.5 | 7.2 | V |
| Stabilized power supply current | $I_{51}$ | Current at $V_{51}$ = 5 V | 2 | 5 | 7 | mA |
| Stabilized power supply input resistance | $R_{51}$ | DC measurement<br>Gradient between $I_{51}$ = 10 mA and 25 mA | 1 | 5 | 10 | Ω |
| VIF circuit (Typical input $f_P$ = 38.9 MHz, $V_{IN}$ = 90 dBμ, DAC Data are typical) | | | | | | |
| Video detection output (typ.) | $V_{PO}$ | Modulation m = 87.5%<br>Data 0A = 88 | 1.75 | 2.1 | 2.5 | V[p-p] |
| Video detection output (max.) | $V_{POmax}$ | Data 0A = F8 | 2.15 | 2.6 | 3.3 | V[p-p] |
| Video detection output (min.) | $V_{POmin}$ | Data 0A = 08 | 1.1 | 1.6 | 2.0 | V[p-p] |
| Video detection output f characteristics | $f_{PC}$ | Frequency to become –3 dB for 1 MHz | 5.5 | 8 | 12 | MHz |
| Sync. peak value voltage | $V_{SP}$ | Sync. peak voltage in $V_{PO}$ measurement | 1.6 | 2.0 | 2.4 | V |
| APC pull-in range (high) | $f_{PPH}$ | High band side pull-in range<br>(Difference from $f_P$ = 38.9 MHz) | 1.0 | 2.0 | — | MHz |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VIF circuit (continued) (Typical input $f_P$ = 38.9 MHz, $V_{IN}$ = 90 dBμ, DAC Data are typical) | | | | | | |
| APC pull-in range (low) | $f_{PPL}$ | Low band side pull-in range (Difference from $f_P$ = 38.9 MHz) | — | –2.0 | –1.0 | MHz |
| RF AGC delay point adjusting range | $\Delta V_{RFDP}$ | Input to become delay point ($V_{27}$ = approx. 6.5 V) at Data 0C = 00 to 7F | 75 | — | 95 | dBμ |
| VCO free-running frequency | $\Delta f_P$ | Dispersion without input $V_{IN}$, $V_{36}$ (IF AGC) = 0 V (Measurement of difference from 38.9 MHz) | –1.2 | 0 | 1.2 | MHz |
| RF AGC maximum sink current | $I_{RFmax}$ | Maximum current IC can sink when pin 27 is low | 1.5 | 3.0 | — | mA |
| RF AGC minimum sink current | $I_{RFmin}$ | IC leakage current at which pin 27 is high | –50 | 0 | 50 | μA |
| AFT discrimination sensitivity | $\mu_{AFT}$ | Df = ±25 kHz | 40 | 57 | 75 | mV/kHz |
| AFT center voltage | $V_{AFT}$ | $V_{30}$ without input $V_{IN}$ | 4.0 | 4.5 | 5.0 | V |
| AFT maximum output voltage | $V_{AFTmax}$ | $V_{30}$ at f = $f_P$ – 500 kHz | 7.8 | 8.1 | 8.7 | V |
| AFT minimum output voltage | $V_{AFTmin}$ | $V_{30}$ at f = $f_P$ + 500 kHz | 0.3 | 0.8 | 1.0 | V |
| Detection output resistance | $R_{O39}$ | DC measurement | 70 | 120 | 170 | Ω |
| External mode output DC voltage | $V_{39EXT}$ | Output DC voltage in AV SW external mode (04 – D6 = 1) | 0.5 | 1.0 | 1.8 | V |
| SIF circuit (Typical input $f_S$ = 6.0 MHz, $f_M$ = 400 Hz, $V_{IN}$ = 90 dBμ) | | | | | | |
| Audio detection output (PAL) | $V_{SOP}$ | Δf = ±50 kHz<br>0D – D7 = 0, $R_{237}$ = 560 kΩ | 480 | 600 | 720 | mV[rms] |
| Audio detection output (NTSC/PAL) | $R_{SN/P}$ | Δf = ±25 kHz, $R_{237}$ = 560 kΩ<br>0D – D7 = 1, ratio to PAL | –2.5 | – 0.5 | 1.5 | dB |
| Audio detection output linearity | $\Delta V_{SOP}$ | Ratio of at $f_S$ = 6.0 MHz to 6.5 MHz, and to 5.5 MHz (270 kΩ addition between pin 37 and $V_{CC1}$) | –2.5 | 0 | 2.5 | dB |
| SIF pull-in range (PAL) | $f_{SPP}$ | PAL mode (0D – D7 = 0) pull-in range $R_{237}$ = 560 kΩ | 5.7 | — | 6.8 | MHz |
| SIF pull-in range (NTSC) | $f_{SPN}$ | NTSC mode (0D – D7 = 1) pull-in range range $R_{237}$ = 560 kΩ | 4.2 | — | 4.8 | MHz |
| SIF pull-in range (5.5 MHz) | $f_{SP5.5}$ | PAL mode (0D – D7 = 0)<br>270 kΩ addition between pin 37 and $V_{CC1}$ | 5.2 | — | 5.8 | MHz |
| SIF input resistance | $R_{I34}$ | DC measurement | 8 | 10 | 12 | kΩ |
| De-emphasis pin output resistance (PAL) | $R_{29P}$ | Impedance of pin 29 at PAL | 32 | 40 | 48 | kΩ |
| De-emphasis pin output resistance (NTSC) | $R_{29N}$ | Impedance of pin 29 at NTSC | 48 | 60 | 72 | kΩ |
| AV SW circuit | | | | | | |
| Video SW voltage gain | $G_{VSW}$ | f = 1 MHz, $V_{IN}$ = 1 V[p-p] | 6.2 | 7.2 | 8.2 | dB |
| Video SW f characteristics | $f_{VSW}$ | Frequency to become –3 dB from f = 1 MHz | 10 | — | — | MHz |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| AV SW circuit (continued) | | | | | | |
| Video SW external input pin voltage | $V_{31}$ | DC measurement | 1.7 | 2.0 | 2.3 | V |
| Video SW external output DC voltage | $V_{36E}$ | DC measurement Data 04 – D6 = 1 | 4.2 | 4.8 | 5.4 | V |
| Video SW external input resistance | $R_{I31}$ | DC measurement | 44 | 56 | 68 | kΩ |
| Video SW output resistance | $R_{O36}$ | DC measurement | 100 | 140 | 180 | Ω |
| Audio SW voltage gain | $G_{ASW}$ | Data 04 – D6 = 1 (Outside)<br>f = 400 Hz, $V_{IN}$ = 1 V[p-p] | –1 | 0 | 1 | dB |
| Audio SW input pin voltage | $V_{33}$ | DC measurement | 3.7 | 4.2 | 4.7 | V |
| Audio SW input output DC voltage | $V_{28}$ | DC measurement | 3.7 | 4.2 | 4.7 | V |
| Audio SW input resistance | $R_{I31}$ | DC measurement | 61 | 72 | 83 | kΩ |
| Audio SW output resistance | $R_{O28}$ | DC measurement | 200 | 400 | 600 | Ω |
| Video SW internal clamp pin voltage | $V_{38}$ | DC measurement | 1.3 | 1.6 | 1.9 | V |
| Video SW internal output DC voltage | $V_{36I}$ | DC measurement, Data 04 – D6 = 0 | 3.1 | 3.7 | 4.3 | V |
| Video signal processing circuit (In the following test conditions, the measurements are made with input 0.6 V[p-p] ($V_{WB}$ = 0.42 V[0-p]) stair-step, G-out.) | | | | | | |
| Video output (typ.) | $V_{YO}$ | Data 03 = 40 (typ.) (Contrast) | 1.65 | 2.1 | 2.55 | V[p-p] |
| Video output (max.) | $V_{YOmax}$ | Data 03 = 7F (max.) | 3.6 | 4.5 | 5.35 | V[p-p] |
| Video output (min.) | $V_{YOmin}$ | Data 03 = 00 (min.) | 0.07 | 0.25 | 0.5 | V[p-p] |
| Contrast variable range | $Y_{Cmax/min}$ | $\frac{03 = 7F}{03 = 00}$ | 20 | 25 | 33 | dB |
| Video frequency characteristics | $fY_C$ | Data 0E – D1 = 1(Trap Off)<br>Data 04 = 00 (Sharpness)<br>Frequency to become –3 dB from f = 0.2 MHz | 5.5 | 6.8 | — | MHz |
| Picture quality variable range | $Y_{Smax/min}$ | $\frac{04 = 3F}{04 = 00}$ f = 3.8MHz<br>Data 0E – D1 = 1 | 9 | 13 | 17 | dB |
| Pedestal level (typ.) | $V_{PED}$ | Data 02 = 80 (typ.) (Brightness) | 1.9 | 2.5 | 3.1 | V |
| Pedestal level variable width | $\Delta V_{PED}$ | Difference between Data 02 = 00 and FF | 2.0 | 2.6 | 3.2 | V |
| Brightness control sensitivity | $\Delta V_{BRT}$ | Average amount of change for 1 Step between Data 02 = 60 and A0 | 7 | 11 | 14 | mV/Step |
| Video input clamp voltage | $V_{YCLP}$ | Clamp voltage of pin 43 | 3.2 | 3.7 | 4.2 | V |
| ACL sensitivity | ACL | Change of Y-out when $V_{20}$ = 3.0 V→3.5 V | 2.1 | 2.7 | 3.2 | V/V |
| Blanking Off threshold voltage | $V_{BOFF}$ | Maximum blanking Off voltage in lowering pin 42 voltage | 0.3 | 0.5 | 0.9 | V |
| Blanking level | $V_{YBL}$ | DC voltage of blanking pulse | 0.5 | 1.0 | 1.5 | V |
| DC restoration ratio | $T_{DC}$ | APL 10% to 90%<br>$T_{DC} = \frac{\Delta AC - \Delta DC}{\Delta AC} \times 100$ | 90 | 100 | 110 | % |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Video signal processing circuit (continued) (In the following test conditions, the measurements are made with input: 0.6 V[p-p] ($V_{WB}$ = 0.42 V[0-p] stair-step) at G-out.) | | | | | | |
| Video input clamp current | $I_{YCLP}$ | DC measurement: IC inside sink current | 8 | 13 | 18 | μA |
| ACL start point | $V_{ACL}$ | $V_{20}$ at which output amplitude becomes 90% in decreasing ACL pin ($V_{20}$) from 5 V | 3.4 | 3.7 | 4.0 | V |
| Color signal processing circuit (In the following test conditions, burst 300 mV[p-p] (PAL) and reference is B-out) | | | | | | |
| Color-difference output (typ.) | $V_{CO}$ | Input: Color bar<br>Data 00 = 40 (typ.), 03 = 40 (typ.) | 2.6 | 3.3 | 4.0 | V[p-p] |
| Color-difference output (max.) | $V_{COmax}$ | Data 00 = 7F amplitude of one side<br>Data 03 = 40 | 2.3 | 3.0 | — | V[0-p] |
| Color-difference output (min.) | $V_{COmin}$ | Data 00 = 00<br>Data 03 = 40 | 0 | — | 100 | mV[p-p] |
| Contrast variable range | $C_{Cmax/min}$ | 03 = FF Data 00 = 40<br>03 = 00 | 20 | 25 | 33 | dB |
| ACC characteristics 1 | ACC1 | Burst 300 mV[p-p]→600 mV[p-p]<br>Input; Rainbow | 0.9 | 1.0 | 1.2 | Time |
| ACC characteristics 2 | ACC2 | Burst 300 mV[p-p]→60 mV[p-p]<br>Input; Rainbow | 0.7 | 1.0 | 1.1 | Time |
| NTSC tint center | $\Delta\theta_C$ | Difference from Data = 01 = 40 (Tint) at which tint is adjusted to center. | –13 | 0 | +13 | Step |
| NTSC tint variable range 1 | $\Delta\theta_1$ | Data 01 = 7F | 30 | 50 | 65 | deg |
| NTSC tint variable range 2 | $\Delta\theta_2$ | Data 01 = 00 | –65 | –50 | –30 | deg |
| Color-difference output ratio (R) | R/B | Input; Rainbow for both PAL/NTSC | 0.71 | 0.83 | 0.95 | Time |
| Color-difference output ratio (G) | G/B | Input; Rainbow for both PAL/NTSC | 0.31 | 0.37 | 0.43 | Time |
| Color-difference output angle (R) | ∠R | Input; Rainbow for both PAL/NTSC | 78 | 90 | 102 | deg |
| Color-difference output angle (G) | ∠G | Input; Rainbow for both PAL/NTSC | 224 | 236 | 248 | deg |
| PAL color killer tolerance | $V_{KillP}$ | 0 dB = 300 mV[p-p] | –57 | –44 | –34 | dB |
| NTSC color killer tolerance | $V_{KillN}$ | 0 dB = 300 mV[p-p] | –57 | –44 | –34 | dB |
| APC pull-in range (high) | $f_{CPH}$ | For both PAL/NTSC | 450 | 900 | — | Hz |
| APC pull-in range (low) | $f_{CPL}$ | For both PAL/NTSC | — | –900 | –450 | Hz |
| Color killer detection output voltage (Color) | $V_{KC}$ | $V_5$ measured when chroma is input | 4.5 | 5.0 | — | V |
| Color killer detection output voltage (B&W) | $V_{KBW}$ | $V_5$ measured when no chroma is input | 0 | 0.1 | 0.5 | V |
| Demodulation output-(B-Y) | $V_{DB}$ | Input; Color bar, measurement by pin 60 | 555 | 695 | 835 | mV[p-p] |
| Demodulation output-(R-Y) | $V_{DR}$ | Input; Color bar, measurement by pin 61 | 430 | 540 | 650 | mV[p-p] |
| Demodulation output angle ∠B | $\angle_{RDB}$ | Phase shift of B-Y axis | –5 | 0 | 5 | deg |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Color signal processing circuit (continued) (In the following test conditions, burst 300 mV[p-p] (PAL) and reference is B-out) | | | | | | |
| Demodulation output angle ∠R | $\angle_{RDR}$ | Phase difference from B-Y axis | 85 | 90 | 95 | deg |
| CW output level (4.43 MHz) | $V_{CWP}$ | AC component when $V_{CO}$ is set at 4.43 MHz | 250 | 300 | 350 | mV[p-p] |
| CW output level (3.58 MHz) | $V_{CWN}$ | AC component when $V_{CO}$ is set at 3.58 MHz | — | 0 | 50 | mV[p-p] |
| CW output level period (SECAM) | $T_{CW}$ | CW output period at SECAM | 1.31 | 1.41 | 1.51 | ms |
| SECAM discrimination current | $I_{SECAM}$ | Minimum value for taking out current from pin 59 and discriminating as SECAM | 50 | 100 | 150 | μA |
| PAL/NTSC DC level | $V_{59PN}$ | $V_{59}$ DC level at PAL/SECAM | 0.8 | 1.3 | 1.65 | V |
| SECAM DC level | $V_{59S}$ | $V_{59}$ DC level at SECAM | 4.1 | 4.6 | 5.1 | V |
| PAL/NTSC output impedance | $R_{60,61PN}$ | DC measurement. pin 60, 61 impedance at PAL/NTSC | 390 | 480 | 570 | Ω |
| SECAM output impedance | $R_{60,61S}$ | DC measurement. pin 60, 61 impedance at SECAM | 100 | — | — | kΩ |
| RGB Processing Circuit (DAC Data are typical) | | | | | | |
| Pedestal difference voltage | $\Delta V_{IPL}$ | Difference voltage of R,G,B out pedestal | 0 | — | 0.3 | V |
| Brightness voltage tracking | $\Delta T_{BL}$ | R, G, B out fluctuation level ratio of DATA 02 (Brightness) 02 = 40 to C0 | 0.9 | 1.0 | 1.1 | Time |
| Video voltage gain relative ratio | $\Delta G_{YC}$ | Output ratio of R,B out to G out | 0.8 | 1.0 | 1.2 | Time |
| Video voltage gain tracking | $\Delta T_{CONT}$ | Gain ratio of R, G, B out of Data 03 (Contrast) 03 = 20 to 60 | 0.9 | 1.0 | 1.1 | Time/ Time |
| Drive adjustment range | $G_{DV}$ | AC change amount of R, B out between drive adjustment max. and min. | 5.3 | 6.3 | 7.3 | dB |
| Cut-off adjustment range | $V_{CUT-OFF}$ | DC change amount of R, G, B out between cutoff adjustment at max. and min. | 1.9 | 2.2 | 2.5 | V |
| $Y_S$ threshold voltage | $V_{YS}$ | Minimum DC voltage, when YS turns on | 0.7 | 1.0 | 1.3 | V |
| External RGB pedestal voltage | $V_{EPL}$ | $Y_S$ is On | 1.7 | 2.3 | 2.9 | V |
| External RGB pedestal difference voltage | $\Delta V_{EPL}$ | $Y_S$ is On | 0 | — | 250 | mV |
| Internal and external pedestal difference voltage | $\Delta V_{PL/IE}$ | Internal-external | 50 | 200 | 400 | mV |
| External RGB output voltage | $V_{ERGB}$ | Input 3 V[p-p], contrast 03 = 7F | 4.3 | 5.4 | 6.5 | V[p-p] |
| External RGB output difference voltage | $\Delta V_{ERGB}$ | Input 3 V[p-p], contrast 03 = 7F | – 0.6 | 0 | 0.6 | V |
| External RGB contrast variable range | $E_{Cmax/min}$ | $\frac{03 = 7F}{03 = 00}$ | 10 | 13 | 16 | dB |
| External RGB frequency characteristics | $f_{RGBC}$ | Input 0.2 V[p-p], DC = 1 V | 8 | 12 | — | MHz |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Synchronizing signal processing circuit | | | | | | |
| Horizontal free-running oscillation frequency | $f_{HO}$ | Without sync. signal input | 15.33 | 15.63 | 15.93 | kHz |
| Horizontal output pulse duty cycle | $\tau_{HO}$ | Upward going pulse duty cycle | 31 | 37 | 43 | % |
| Horizontal pull-in range | $f_{HP}$ | Difference from $f_H$ = 15.625 kHz | ±500 | ±650 | — | Hz |
| PAL vertical free-running oscillation frequency | $f_{VO-P}$ | Data 0E – D2 = 1, D3 = 0<br>Forced 50 Hz mode, no sync. signal input | 48 | 50 | 52 | Hz |
| NTSC vertical free-running oscillation frequency | $f_{VO-N}$ | Data 0E – D2 = 1, D3 = 1<br>Forced 60 Hz mode, no sync. signal input | 58 | 60 | 62 | Hz |
| Vertical output pulse width | $\tau_{VO}$ | For both PAL/NTSC | 9 | 10 | 11 | $1/f_H$ |
| PAL vertical pull-in range | $f_{VP-P}$ | $f_H$ = 15.625 kHz, forced 50 Hz mode | 46 | — | 54 | Hz |
| NTSC vertical pull-in range | $f_{VP-N}$ | $f_H$ = 15.75 kHz, forced 60 Hz mode | 56 | — | 64 | Hz |
| Horizontal output voltage (high) | $V_{56H}$ | High level DC voltage | 3.2 | 3.5 | 3.8 | V |
| Horizontal output voltage (low) | $V_{56L}$ | Low level DC voltage | 0 | — | 0.3 | V |
| Vertical output voltage (high) | $V_{58H}$ | High level DC voltage | 3.9 | 4.2 | 4.5 | V |
| Vertical output voltage (low) | $V_{58L}$ | Low level DC voltage | 0 | — | 0.3 | V |
| Picture center variable range | $\Delta T_{HC}$ | Change amount of phase difference between H Sync. and H-out of Data 0A = 80 to 8F | 2.6 | 3.2 | 4.4 | µS |
| Overvoltage protective operation voltage | $V_{XRAY}$ | Pin 55 minimum voltage at which H-out stops to appear | 0.60 | 0.68 | 0.76 | V |
| Vertical frequency discrimination (50) | $f_{50}$ | Vertical frequency to become $V_{57}$ = Low (< 0.5 V) | 47 | — | 55 | Hz |
| Vertical frequency discrimination (60) | $f_{60}$ | Vertical frequency to become $V_{57}$ = High (> 4.5 V) | 57 | — | 63 | Hz |
| Sync. signal clamp voltage (Ver.) | $V_{45}$ | Clamp voltage of $V_{45}$ | 1.0 | 1.3 | 1.6 | V |
| Sync. signal clamp voltage (Hor.) | $V_{46}$ | Clamp voltage of $V_{46}$ | 1.0 | 1.3 | 1.6 | V |
| Horizontal output start voltage | $V_{fHS}$ | Minimum $V_{50}$ to become $f_0$ > 10 kHz, when horizontal oscillation output is 1 V[p-p] or more. | 3.4 | 4.2 | 5.0 | V |
| $I^2C$ interface | | | | | | |
| Sink current when ACK | $I_{ACK}$ | Maximum value of pin 21 sink current at ACK | 2.0 | 2.5 | 5.0 | mA |
| SCL, SDA signal input high level | $V_{IHI}$ | | 3.1 | — | 5.0 | V |
| SCL, SDA signal input low level | $V_{ILO}$ | | 0 | — | 0.9 | V |
| Maximum frequency allowable to input | $f_{Imax}$ | | 100 | — | — | Kbit/s |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

• Design reference data

Note) The characteristic listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VIF circuit (Typical input $f_P$ = 38.9 MHz, $V_{IN}$ = 90 dBμ) | | | | | | |
| Input sensitivity | $V_{PS}$ | Input level to become $V_{PO}$ = −3 dB | — | 45 | 51 | dBμ |
| Maximum allowable input | $V_{Pmax}$ | Input level to become $V_{PO}$ = 1 dB | 104 | 110 | — | dBμ |
| SN ratio | $SN_P$ | | 50 | 53 | — | dB |
| Differential gain | $DG_P$ | | 0 | 3 | 5 | % |
| Differential phase | $DP_P$ | | 0 | 3 | 5 | deg |
| Black noise detection level | $\Delta V_{BN}$ | Deference from sync. peak value | −55 | −45 | −35 | IRE |
| Black noise clamp level | $\Delta V_{BNC}$ | Deference from sync. peak value | 35 | 45 | 35 | IRE |
| RF AGC operation sensitivity | $G_{RF}$ | Input level difference to become $V_{27}$ = 1 V→7 V | 0.5 | 1.5 | 3.0 | dB |
| VCO switch On drift | $\Delta f_{PD}$ | Frequency drift from 5 seconds to 5 mins. after SW On | 100 | 150 | 200 | kHz |
| Intermodulation | IM | $V_{fC} - V_{fP}$ = −2 dB, $V_{fS} - V_{fP}$ = −12 dB | 46 | 52 | — | dB |
| RF AGC adjustment sensitivity | $S_{RF}$ | Average amount of change of output voltage $V_{27}$ at Data 1Step | 1.0 | 1.7 | 2.5 | V/Step |
| AFT offset adjustment sensitivity | $S_{AFT}$ | Average amount of change of output voltage $V_{30}$ per Data 1Step | 0.15 | 0.2 | 0.25 | V/Step |
| Video detection output fluctuation with $V_{CC}$ | $\Delta V_{P/V}$ | $V_{CC}$ = ±10% | — | ±10 | ±15 | % |
| Video detection output-temperature characteristics | $\Delta V_{P/T}$ | $T_a$ = −10°C to +70°C | — | ±5 | ±10 | % |
| Input resistance (pin 24, 25) | $R_{I24, 25}$ | f = 38.9 MHz | — | 1.2 | — | kΩ |
| Input capacitance (pin 24, 25) | $C_{I24, 25}$ | f = 38.9 MHz | — | 4.0 | — | pF |
| Sound IF output level | $V_{SIF}$ | $f_S$ = 38.9 MHz − 6.0 MHz, P/S = 20 dB | 94 | 100 | 106 | dBμ |
| VCO control sensitivity | $\beta_P$ | $\Delta V_{41}$ = ±0.1 V | 2.0 | 2.7 | 3.5 | kHz/mV |
| VCO control range | $f_{VCO}$ | Free-running frequency change width from Data 0D = 00 to 7F | 3.0 | 4.0 | 5.0 | MHz |
| RF AGC delay-point temperature characteristics | $\Delta V_{DP/T}$ | $T_a$ = −20°C to +70°C | 0 | 3 | 5 | dB |
| VCO free-running frequency temperature characteristics | $\Delta f_{P/T}$ | $T_a$ = −20°C to +70°C | — | 300 | — | kHz |
| AFT center frequency temperature characteristics | $\Delta f_{AFT/T}$ | $T_a$ = −20°C to +70°C, input frequency at which AFT output voltage becomes 4.5 V | — | 300 | — | kHz |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

• Design reference data (continued)

Note) The characteristic listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| SIF circuit (Typical input $f_S$ = 6.0 MHz, $f_M$ = 400 Hz, $V_{IN}$ = 90 dBμ) | | | | | | |
| Input limiting level | $V_{LIM}$ | Input level to become $V_{SOP}$ = −3 dB | — | 44 | 50 | dBμ |
| AM rejection ratio | AMR | AM = 30% | 60 | 70 | — | dB |
| Total harmonic distortion | THD | Δf = ±50 kHz | 0 | 0.3 | 0.5 | % |
| SN ratio | $SN_A$ | | 50 | 55 | — | dB |
| Audio output with $V_{CC}$ fluctuation | $\Delta V_{S/V}$ | $V_{CC}$ = ±10% | — | ±3 | ±6 | % |
| Audio output-temperature characteristics | $\Delta V_{S/T}$ | $T_a$ = −20°C to +70°C | — | ±5 | ±10 | % |
| AV SW circuit | | | | | | |
| Video SW cross-talk | $CT_{VSW}$ | f = 1 MHz, $V_{IN}$ = 1 V[p-p]<br>Internal→External、External→Internal | — | −66 | −60 | dB |
| Audio SW cross-talk<br>(Internal→External) | $CT_{AIE}$ | $f_S$ = 6.0 MHz, $f_M$ = 400 Hz<br>Without input from outside | — | −73 | −67 | dB |
| Audio SW cross-talk<br>(External→Internal) | $CT_{AEI}$ | $f_S$ = 6.0 MHz, $f_M$ = 0 Hz<br>$f_M$ = 400 Hz, $V_{IN}$ = 600 mV[rms] | — | −73 | −67 | dB |
| Video signal processing circuit (In the following test conditions, the measurements are made at G-out with input 0.6 V[p-p] ($V_{WB}$ = 0.42 V[0-p]). ) | | | | | | |
| Y signal delay time | $T_{DL}$ | Phase difference from Y input (PAL: 4.43 MHz) | 620 | 690 | 790 | ns |
| Black level extension1 | $V_{BL1}$ | Input: Total black, difference between pin 42 of 9 V and Open (With RC filter) | −100 | 0 | 100 | mV |
| Black level extension2 | $V_{BL2}$ | Input: Total black, difference between pin 42 of 3 V and 9 V | 500 | 800 | 1100 | mV |
| Black level extension3 | $V_{BL3}$ | Input: approx. 20IRE, voltage difference between pin 42 of Open and 9 V | 100 | 300 | 500 | mV |
| Contrast variation with sharpness | $\Delta V_{CS}$ | Y-out output level difference between sharpness max. and min. | −300 | 0 | 300 | mV |
| Brightness variation with sharpness | $\Delta V_{BS}$ | Pedestal level DC difference between sharpness is at max. and min. | −250 | 0 | 250 | mV |
| Input dynamic range | $VI_{max}$ | Contrast 03 = 40 | 1.0 | 1.7 | — | V[p-p] |
| Y signal SN ratio | $SN_Y$ | Contrast 03 = 7F | 51 | 56 | — | dB |
| Black level extension start point | $V_{BLS}$ | Start point at $V_{48}$ = 4.5 V | 37 | 42 | 47 | IRE |
| Trap on/off gain difference | $\Delta G_{TRAP}$ | Trap on/off | −1 | 0 | 1 | dB |
| Trap on/off<br>delay time change amount | $\Delta T_{TRAP}$ | Trap on/off | 350 | 390 | 430 | ns |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

• Design reference data (continued)

Note) The characteristic listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Video signal processing circuit (continued) (In the following test conditions, the measurements are made at G-out with input 0.6 V[p-p] ($V_{WB}$ = 0.42 V[0-p]). | | | | | | |
| Trap frequency error | $\Delta f_{TRAP}$ | Trap center frequency, when chroma input is 4.43 MHz | –70 | 0 | 70 | kHz |
| Trap attenuation amount | $A_{TT\ TRAP}$ | Attenuation amount of 4.43 MHz, when chroma input is 4.43 MHz | 26 | 30 | — | dB |
| Trap automatic adjustment range | $f_{TRAP}$ | VCO frequency of $\Delta f_{TRAP} \leq$ 70 kHz | 3 | — | 5 | MHz |
| Trap fixed frequency | $f_{ST}$ | Data 0E – D6 = 1, Trap frequency | 4.0 | 4.8 | 5.6 | MHz |
| Video output fluctuation with $V_{CC}$ | $\Delta V_{Y/V}$ | $V_{CC1}$ = 9 V (allowance: ±10%) | 0 | 100 | 200 | mV/V |
| Video output-temperature characteristics | $\Delta V_{Y/T}$ | $T_a$ = –20°C to +70°C | 0 | 5 | 10 | % |
| PAL/NTSC delay time difference | $\Delta T_{P/N}$ | Trap On (NTSC-PAL) | –10 | 10 | 30 | ns |
| Color signal processing circuit (Burst 300 mV[p-p] (PAL), reference is B-out) | | | | | | |
| Demodulation output residual carrier | $V_{CAR1}$ | $2f_{SC}$ level of pin 60 and 61 | 0 | — | 30 | mV |
| Color difference output residual carrier | $V_{CAR2}$ | $2f_{SC}$ level of pin 15, 16, and 17 | 0 | — | 50 | mV |
| VCO free-running frequency (PAL) | $f_{CP}$ | Difference from f = 4.433619 MHz | –300 | 0 | 300 | Hz |
| VCO free-running frequency (NTSC) | $f_{CN}$ | Difference from f = 3.579545 MHz | –300 | 0 | 300 | Hz |
| $f_{CO}$ fluctuation with $V_{CC}$ | $\Delta V_{C/V}$ | $V_{CC1}$ = 9 V (allowance: ±10%), $V_{CC3}$ = 5 V (allowance: ±10%) | –300 | 0 | 300 | Hz |
| Static phase error (PAL) | $\Delta\theta_P$ | Tint shift from $\Delta f_C$ = –300 Hz to +300 Hz change | 0 | 2 | 5 | deg/ 100 Hz |
| Static phase error (NTSC) | $\Delta\theta_N$ | Tint shift from $\Delta f_C$ = –300 Hz to +300 Hz change | 0 | 2 | 5 | deg/ 100 Hz |
| PAL/NTSC | $R_{P/N}$ | Output amplitude ratio of PAL to NTSC | 0.8 | 1.0 | 1.2 | Time |
| Line crawling | $\Delta V_{PAL}$ | Pin 61: Output amplitude difference per 1H for-(R-Y) pin | 0 | — | 50 | mV |
| Color difference output bandwidth | $f_{CC}$ | Band to become –3 dB | — | 1.0 | — | MHz |
| Chroma BPF characteristics (PAL) | $BPF_P$ | Output level difference between f = 4.43 MHz and 3.58 MHz | — | 10 | — | dB |
| Chroma BPF characteristics (NTSC) | $BPF_N$ | Output level difference between f = 3.58 MHz and 2.0 MHz (when Ext. video) | — | 13 | — | dB |
| Color-difference output fluctuation with $V_{CC}$ | $\Delta V_{C/V}$ | $V_{CC1}$ = 9V (allowance: ±10%) $V_{CC3}$ = 5V (allowance: ±10%) | — | ±10 | ±15 | % |
| Color-difference output -temperature characteristics | $\Delta V_{C/T}$ | $T_a$ = –20°C to +70°C | — | ±10 | ±15 | % |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

• Design reference data (continued)

Note) The characteristic listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Color signal processing circuit (continued) (Burst 300 mV[p-p] (PAL), reference is B-out) | | | | | | |
| Brightness variation with color | $V_{BC}$ | Pedestal level DC difference between at contrast max. and min. | −250 | 0 | 250 | mV |
| Brightness variation difference voltage with color | $\Delta V_{BC}$ | R, G, B out variation voltage difference | 0 | — | 20 | mV |
| RGB processing circuit | | | | | | |
| (C-Y)/Y | $R_{C/Y}$ | Color bar input, B-out Contrast typ., color Data 00 = 60 | 0.9 | 1.2 | 1.5 | V[0-p]/ V[p-p] |
| (C-Y), Y delay difference | $\Delta T_{C/Y}$ | Color bar input, B-out Phase of green→magenta | −100 | 0 | 100 | ns |
| $Y_S$ changeover speed | $f_{YS}$ | $f_{YS,}$ when external input is 3 V, output level −3 dB | 7 | 11 | — | MHz |
| External RGB input dynamic range | $V_{DEXT}$ | Contrast max., Data 03 = 77F | 2.0 | 2.5 | 3.2 | V[0-p] |
| Internal/external crosstalk | $CT_{RGB}$ | Leakage when f = 1 MHz, 1 V[p-p], and $Y_S$ = 5 V | — | −60 | −50 | dB |
| Spot killer operation | $V_{SPK}$ | $V_{9,}$ when $V_9$ is decreased from 9 V and spot killer turns on. | 7.4 | 7.8 | 8.2 | V |
| Brightness variation with contrast | $V_{BAC}$ | Pedestal level DC difference between contrast max. and min. | −250 | 0 | 250 | mV |
| Brightness variation difference voltage with contrast | $\Delta V_{BAC}$ | R, G, B out variation voltage difference | 0 | — | 20 | mV |
| Pedestal level fluctuation with $V_{CC}$ | $\Delta V_{PL/V}$ | $V_{CC1}$ = 9 V (allowance: ±10%) | 0 | 200 | 400 | mV/V |
| Pedestal level- temperature characteristics | $\Delta V_{PL/T}$ | $T_a$ = −20°C to +70°C | −2.6 | −2.2 | −1.8 | mV/°C |
| Pedestal level 2 | $V_{PD2}$ | Pedestal level, when G cutoff Data 05 = 18 | 2.1 | 2.7 | 3.3 | V |
| Synchronizing signal processing circuit | | | | | | |
| Lock detection output voltage | $V_{LD}$ | $V_{18}$ at horizontal AFC lock | 5.7 | 6.3 | 6.9 | V |
| Lock detection charge and discharge current | $I_{LD}$ | DC measurement | ±0.6 | ±0.8 | ±1.1 | mA |
| EBP (RGB) slice level | $V_{FBP}$ | Minimum voltage of pin 50, when blanking is applied to RGB output | 0.4 | 0.75 | 1.1 | V |
| EBP (AFC2) slice level | $V_{FBPH}$ | Minimum voltage of pin 50 at which AFC2 operates | 1.5 | 1.9 | 2.3 | V |
| Horizontal AFC μ | $\mu_H$ | DC measurement | 30 | 37 | 44 | μA/μs |
| Horizontal VCO β | $\beta_H$ | β curve gradient near f = 15.7kHz | 1.4 | 1.9 | 2.4 | Hz/mV |
| Burst gate pulse position | $P_{BGP}$ | For both PAL/NTSC, delay from H. Sync. rise | 0.2 | 0.4 | 0.6 | μs |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

• Design reference data (continued)

Note) The characteristic listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Synchronizing signal processing circuit (continued) | | | | | | |
| PAL burst gate pulse width | $W_{BGPP}$ | | 3.4 | 4.0 | 4.6 | µs |
| NTSC burst gate pulse width | $W_{BGPN}$ | | 2.5 | 3.0 | 3.5 | µs |
| Burst gate pulse output voltage | $V_{BGP}$ | DC voltage of pin 62 in BGP period | 4.5 | 4.7 | 4.9 | V |
| H blanking pulse output voltage | $V_{HBLK}$ | DC voltage in H-blanking pulse period of pin 62 | 2.1 | 2.4 | 2.7 | V |
| V blanking pulse output voltage | $V_{VBLK}$ | DC voltage in V-blanking pulse period of pin 62 | 2.1 | 2.4 | 2.7 | V |
| PAL V blanking pulse width | $W_{VP}$ | Pulse width at $f_H$ = 15.625 kHz | 1.31 | 1.41 | 1.51 | ms |
| NTSC blanking pulse width | $W_{VN}$ | Pulse width at $f_H$ = 15.73 kHz | 1.01 | 1.11 | 1.21 | ms |
| FBP allowable range | $T_{FBP}$ | Time from H-out rise to FBP center | 12 | — | 19 | µs |
| $I^2C$ interface | | | | | | |
| Bus free before start | $t_{BUF}$ | | 4.0 | — | — | µs |
| Start condition set-up time | $t_{SU.STA}$ | | 4.0 | — | — | µs |
| Start condition hold time | $t_{HD.STA}$ | | 4.0 | — | — | µs |
| Low period SCL, SDA | $t_{LOW}$ | | 4.0 | — | — | µs |
| High period SCL | $t_{HIGH}$ | | 4.0 | — | — | µs |
| Rise time SCL, SDA | $t_r$ | | — | — | 1.0 | µs |
| Fall time SCL, SDA | $t_f$ | | — | — | 0.35 | µs |
| Data set-up time (write) | $t_{SU.DAT}$ | | 0.25 | — | — | µs |
| Data hold time (write) | $t_{HD.DAT}$ | | 0 | — | — | µs |
| Acknowledge set-up time | $t_{SU.ACK}$ | | — | — | 3.5 | µs |
| Acknowledge hold time | $t_{HD.ACK}$ | | 0 | — | — | µs |
| Stop condition set-up time | $t_{SU.STO}$ | | 4.0 | — | — | µs |
| DAC | | | | | | |
| 4, 6, 7bit DAC DNLE | $L_{4, 6, 7}$ | 1LSB = {Data (max.)-Data (00)} /15,63,127 | 0.1 | 1.0 | 1.9 | $\frac{LSB}{Step}$ |
| 8bit DAC DNLE | $L_8$ | 1LSB = {Data (FF) – Data (00)}/255 | 0.1 | 1.0 | 1.9 | $\frac{LSB}{Step}$ |
| Cut off DAC overlap | ΔStep | Overlap of 8-bit 2-stage changeover (Same for AFT) of R, B cut-off | 27 | 32 | 37 | Step |

■ Electrical Characteristics at $T_a$ = 25°C (continued)

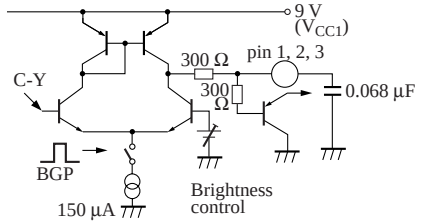
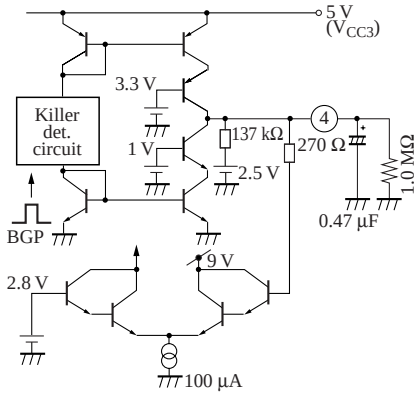
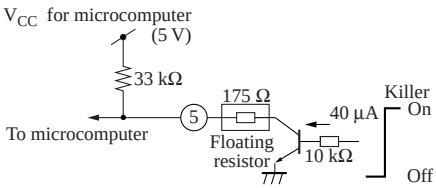
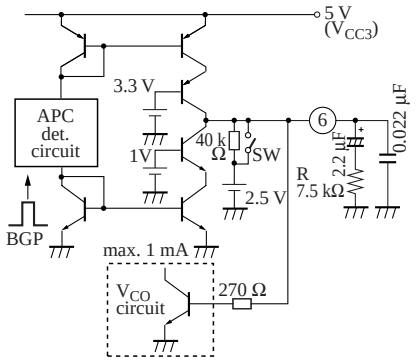
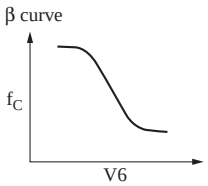
• Typical conditions when testing

1. Input signal
   1) VIF : $f_P$ = 38.9 MHz, $V_{IN}$ = 90 dBμ
      Video modulation: modulated signal is 10-staircase. Modulation m = 87.5%
      $V_{IN}$ = 90 dBμ, pin 25 input level approx. 84 dBμ
   2) SIF : $f_S$ = 6.0 MHz, $V_{IN}$ = 90 dBμ, modulated signal $f_M$ = 400 Hz, Deviation: PAL ±50 kHz, NTSC ±25 kHz
   3) Video : 10-staircase 0.6 V[p-p] ($V_{BW}$ = 0.42 V[0-p])
   4) Chroma : Color bar signal: Burst level 300 mV[p-p]
      : Rainbow signal : Burst level 300 mV[p-p]
   5) Sync. signal : Video signal 1.5V[p-p] to 2.5 V[p-p] for both horizontal and vertical sync. signal input
2. $I^2C$ BUS conditions: (PAL)

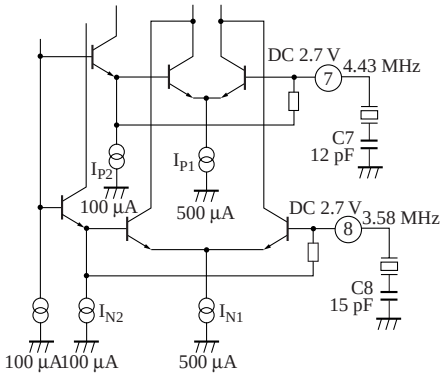
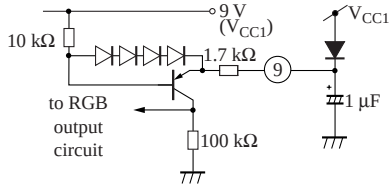
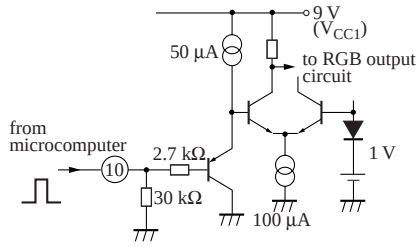
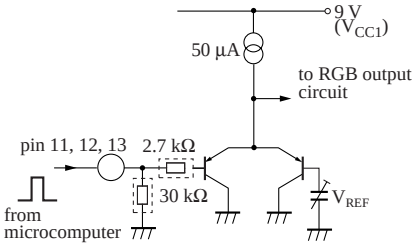
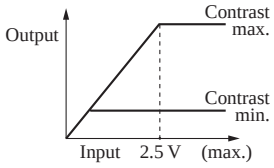
| Sub Address | Data(H) |
|---|---|
| 00 | 40 |
| 01 | 40 |
| 02 | 80 |
| 03 | 40 |
| 04 | 80 |
| 05 | 00 |
| 06 | 00 |
| 07 | 00 |
| 08 | 80 |
| 09 | 80 |
| 0A | 88 |
| 0B | 01 |
| 0C | 40 |
| 0D | 40 |
| 0E | 01 |

| Control | Data(H) |
|---|---|
| Color | 00 = 40 |
| Tint | 01 = 40 |
| Brightness | 02 = 80 |
| Contrast | 03 = 40 |
| Sharpness | 04 = 00 |
| Cut-off R, B | 05, 07 = 00 |
| Cut-off G | 06 = 00 |
| Drive R, B | 08, 09 = 80 |
| Video output | 0A (Upper rank) = 8* |
| Picture center position | 0A (Lower rank) = *8 |
| AFT | 0B = 01<br>04 – D7 = 1 |
| RF AGC | 0C = 40 |
| VIF VCO | 0D = 40 |

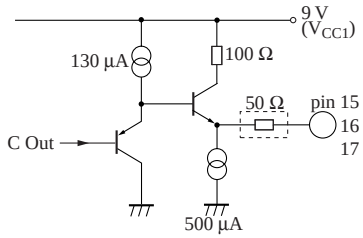
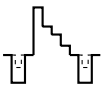
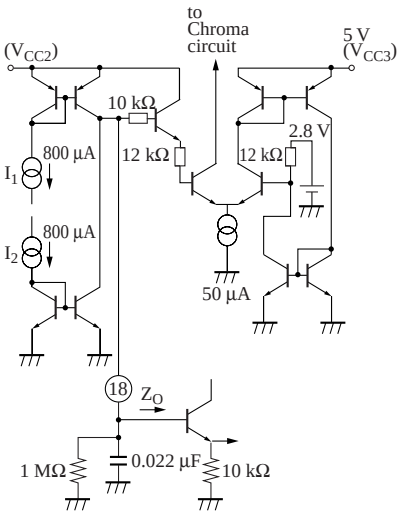
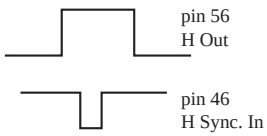
■ Terminal Equivalent Circuits

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 1<br>2<br>3 |  | Pin 1: Color difference signal clamp pin (R-Y)<br>Pin 2: Color difference signal clamp pin (G-Y)<br>Pin 3: Color difference signal clamp pin (B-Y)<br>• Color difference signal inputted from pin 63, 64 is clamped according to brightness control voltage.<br>• Clamp pulse uses internal clamp pulse (BGP) | DC<br>approx. 7 V |
| 4 |  | Killer filter pin<br>• Filter pin for killer detection circuit (operates for BGP period)<br>• Killer turned On (Without color output) 2.8 V or less | DC<br>approx. 3.3 V |
| 5 |  | Killer output pin<br>• Output pin of killer detection circuit<br>• Connect 33 kΩ load resistor of pin 5 to microcomputer $V_{CC}$ | DC<br>Killer On<br>0.2 V<br>Killer Off<br>5 V |
| 6 |  | Pin for APC filter<br>• Filter pin for APC detection circuit (operates for BGP period)<br>• Detection sensitivity becomes large when external R→large (Tends to pull-in easily. Tends to be affected by noise)<br>  <br>• When SECAM, APC circuit is stopped by short circuiting 40 kΩ resistor | DC<br>approx. 2.5 V |

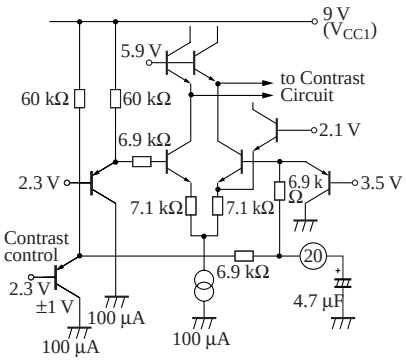
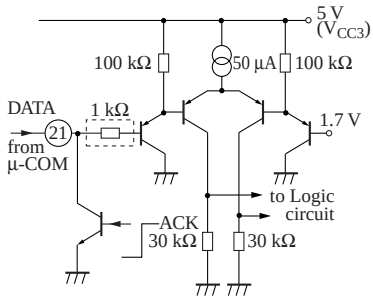
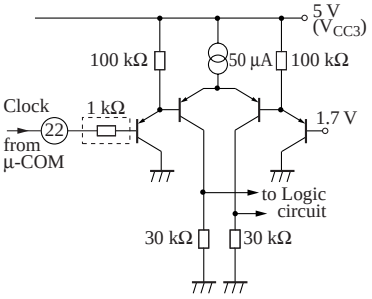
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 7<br>8 |  <br>C7 and C8 have temperature characteristic (N750) | Pin 7: Chroma oscillation pin (4.43 MHz)<br>Pin 8: Chroma oscillation pin (3.58 MHz)<br>• Oscillation pin for chroma. Either one of 4.43 MHz or 3.58 MHz is oscillated<br>• Oscillation frequency changeover is performed by 0E – D0 bit of $I^2C$ Bus<br>• When 0E – D0 = 1<br>$I_{P1}$ and $I_{P2}$ turn On and 4.43 MHz oscillates.<br>When 0E – D0 = 0<br>$I_{N1}$ and $I_{N2}$ turn on and 3.58 MHz oscillates.<br>• Pattern from pin to oscillator element should be as short as possible. | AC<br>$f = f_C$<br>approx.<br>0.3 V[p-p] |
| 9 |  | Spot killer pin<br>• To be used for discharging electric charge on CRT quickly when power of set is turned Off.<br>• DC voltage of R,G,B output pin is raised when $V_{CC1}$ drops. | DC<br>approx. 9 V |
| 10 |  | $Y_S$ input pin<br>• Fast blanking pulse input pin for OSD<br>• Turns on at a voltage higher than 1 V[0-p] | AC<br>(pulse)<br> |
| 11<br>12<br>13 |  | Pin 11: External R input pin<br>Pin 12: External G input pin<br>Pin 13: External B input pin<br>• External input pin for OSD<br>• Output changes linearly according to input level.<br>  <br>• Limit voltage of input changes according to contrast control level. | AC<br>(pulse)<br> |

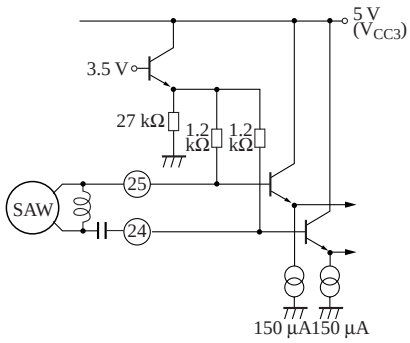
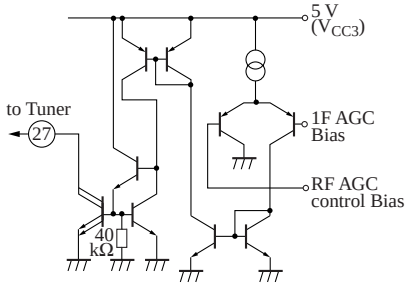
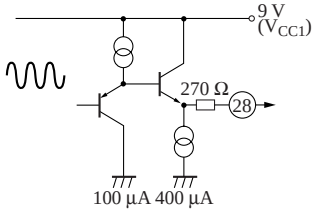
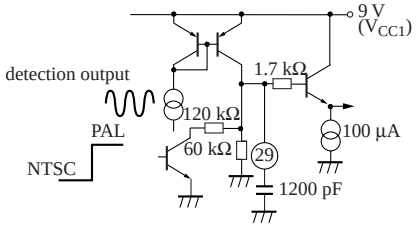
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 14 | | $V_{CC1}$ (typ. 9 V)<br>• Output part of VIF and SIF circuit<br>• AV SW circuit<br>• Video circuit<br>• RGB circuit | DC<br>9 V |
| 15<br>16<br>17 |  | Pin15: R-out pin<br>Pin16: G-out pin<br>Pin17: B-out pin<br>• BLK level approx. 0.9 V<br>• Black (Pedestal) level approx. 2.2 V<br>• Blanking can be released when pin 42 (Black level detection pin) is set at 0 V. | AC<br>  |
| 18 |  | Horizontal sync. detection pin<br>• Phase of horizontal synchronizing signal and horizontal output pulse is detected and outputted.<br>• Pin18 is low when out of phase.<br>• In asynchronous state, color control becomes min. and chroma output disappears.<br>• Pay attention to impedance when the voltage of pin 18 is utilized for microcomputer ($Z_O \geq 1$ MΩ is required)<br>  <br>• H Sync. period<br>When pin 56 is high: $I_1$ On<br>When pin 56 is low: $I_2$ On | DC<br>when synchronous<br>$V_{CC2} - V_{SAT}$<br>when asynchronous<br>approx. 0.3 V |
| 19 | | GND<br>• RGB circuit<br>• DAC $I^2C$ circuit<br>• VIF (VCO) circuit | |

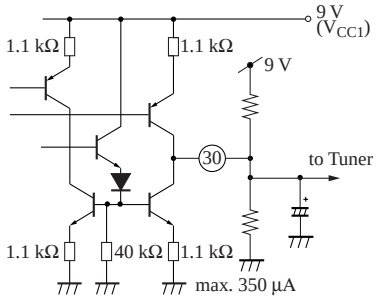
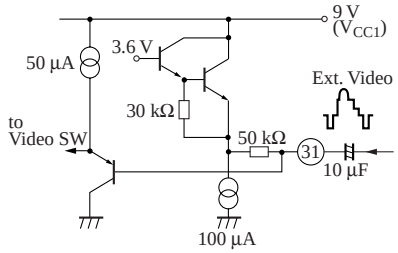
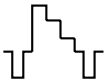
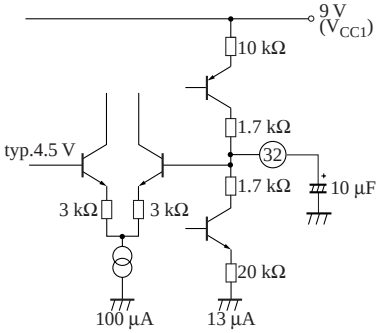
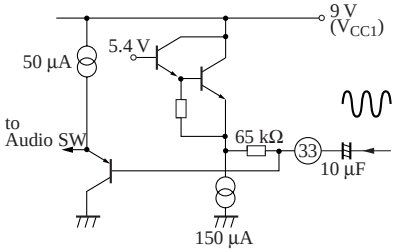
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 20 |  | ACL pin<br>• Contrast can be reduced when DC voltage of pin 20 is decreased from the outside. | DC<br>approx. 3 V |
| 21 |  | $I^2C$ Bus Data input pin | AC<br>(pulse) |
| 22 |  | $I^2C$ Clock input pin | AC<br>(pulse) |
| 23 | | $V_{CC3-1}$ (typ. 5 V)<br>• For VIF, SIF circuit | DC<br>5 V |

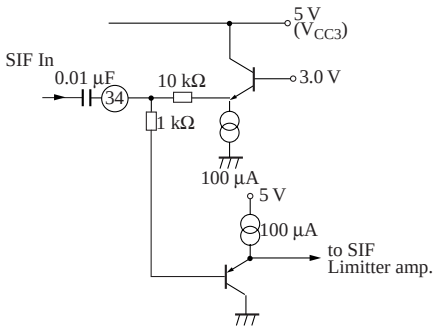
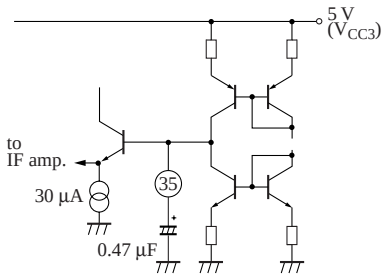
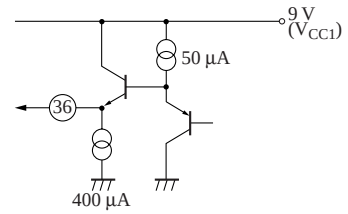
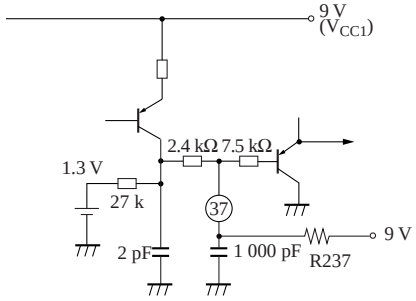
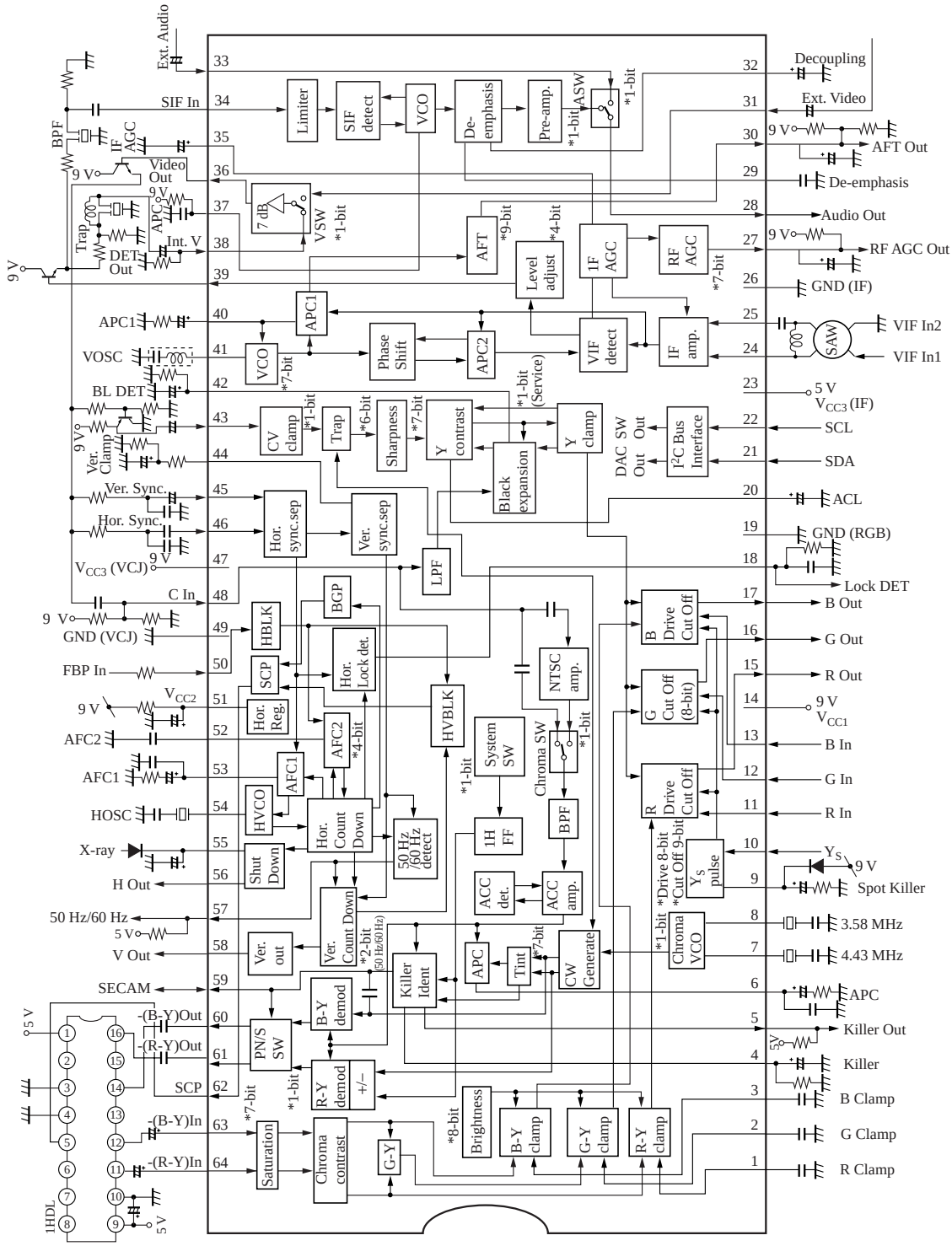
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 24<br>25 |  | Pin 24: VIF input pin 1<br>Pin 25: VIF input pin 2<br>• Input for VIF amp.and balanced input<br>• Input max. 120 dBµ | AC<br>$f = f_P$<br>DC level<br>approx. 2.7 V |
| 26 | | GND<br>• VIF, SIF circuit | DC |
| 27 |  | RF AGC output pin<br>• Collector open output | DC |
| 28 |  | Audio output pin<br>• There is fluctuation of DC due to internal and external changeover | AC<br>0 kHz to 20 kHz<br>DC<br>approx. 4.2 V |
| 29 |  | De-empahsis pin<br>• De-empahsis filter pin for sound detection signal.<br>• External C is the same for PAL and NTSC (Internal impedance changes)<br>• PAL: 120 kΩ//60 kΩ × 1 200 pF = 48 µs<br>• NTSC: 60 kΩ × 1200 pF = 72 µs | AC<br>0 kHz to 20 kHz |

■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 30 |  | AFT output pin<br>• Center voltage offset should be adjusted by using a bus.<br>• AFT defeat SW is turned on (0B = 00), $V_{30}$ becomes a value determined by the value of externally attached resistor-divider.<br>• AFT µ is variable by impedance of externally attached resistor. | DC |
| 31 |  | External video input pin<br>• Input pin for external video signal. DC cut input.<br>• Typical 1 V[p-p] (max. 1.5 V[p-p]) | AC<br>1 V[p-p]<br>(Composite)<br>  <br>DC<br>approx. 2.1 V |
| 32 |  | Decoupling pin<br>• S curve inside IC is wide band but DC feedback is applied so that DC voltage of output signal becomes constant.<br>• DC level (typ. 4.5 V)<br>$f_S$→High: $V_{32}$→Low | DC |
| 33 |  | External audio input pin<br>• Input pin for external audio signal input. DC cut input.<br>• Typical input level should be adjusted to internal sound level.<br>• Input max. 7 V[p-p] | AC<br>0 kHz to 20 kHz |

■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | I/O |
|---|---|---|---|
| 34 |  | SIF Signal input<br>Input max. 110 dBµ | AC<br>$f = f_S$<br>DC<br>approx. 2.3 V |
| 35 |  | IF AGC filter pin<br>• Pin for IF AGC filter. The current obtained from peak AGC circuit is smoothed by external capacitor.<br>• Since response becomes faster when C→small, but sag tends to appear easily. | DC<br>approx. 2 V |
| 36 |  | Video output pin<br>• Int. video or Ext. video signal selected by AV SW is outputted.<br>• DC fluctuates by internal/external changeover | AC<br>2 V[p-p]<br> <br>DC level<br>approx. 4.5 V |
| 37 |  | SIF APC filter pin<br>• Filter pin for APC circuit of SIF<br>• Recommended resistance value for single frequency<br>(R237: Connect between the pin and $V_{CC1}$)<br>6.5 MHz: Open<br>6.0 MHz: 560 kΩ<br>5.5 MHz: 200 kΩ<br>4.5 MHz: 560 kΩ | DC<br>approx. 2.5 V |

■ Application Circuit Example